

EVALUATION OF TIMING GUTHION® SPRAYS ACCORDING TO CONEWORM
INFESTATION LEVELS ON A SHORLEAF PINE SEED ORCHARD

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ABSTRACT

An evaluation was conducted in 1978 and 1979 based on biweekly inspections for coneworm damage^{3/} at Stuart Orchard in Pollock, La. In 1978 "timed" Guthion[®] sprays (applied according to a variable schedule) were applied when 5 percent of the conelets and cones showed coneworm damage. One "timed" Guthion spray in June was as successful for coneworm control as four sprays; one each in May, June, July and August. However, other insects destroyed significantly more cones and 8 times more seed in the "timed" area than the "scheduled" spray area.

In 1979, biweekly examinations of conelets and cones showed low levels of coneworm damage; therefore, the "timed" area was not treated. Coneworm damage in the "timed" area levels was not significantly different from the "scheduled" spray area. Seed damage, however, was significantly greater by 36 percent in the "timed" area.

INTRODUCTION

In untreated southern pine seed orchards, insects often destroy 20 to 60 percent of the improved seed produced annually. Production of orchard seed is becoming increasingly important since it is needed to insure the success of the tree improvement program and to meet the country's growing demand for wood and wood products. Presently, the only means for controlling seed orchard insects, including coneworms (*Dioryctria* spp.), is the application of insecticides on a fixed schedule. These are applied largely as a preventative measure.

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Use of trade does not constitute an endorsement by USDA, Forest Service for a product; similar materials with different names may be equally effective.

Azinphosmethyl (Guthion) is currently used for coneworm control in 4 to 6 applications made monthly from April through September without regard to population levels at time of application. Except for Merkel and Yandle's (1965) work in which they applied spray at different times, little has been done to time Guthion spray applications according to the insects' biology or behavior.

The timing of Guthion sprays according to when coneworm populations justified treatment would be a first step in developing integrated pest management systems for pine seed orchards.

The objective of this evaluation was to apply Guthion for coneworm control when populations showed an increase in infestation levels, and thereby reduce the necessary number of spray applications.

METHODS

Treatment Method and Sampling Procedures

A block of shortleaf pines was divided into three areas: 1) one was left untreated, 2) one was treated on a variable schedule (timed) with Guthion 2S according to observed coneworm damage, and 3) the other sprayed with Guthion 2S on a fixed schedule.

A total of eight cone-producing clones (two ramets per clone) with 12 or more conelets and 12 or more cones per tree were chosen in each of the above areas in the Texas shortleaf geographical source. Ten percent, or a minimum of 10 conelets and 10 cones per tree, were tagged and monitored for coneworm and other damage at biweekly intervals throughout the 1978 and 1979 growing season (March through September).

Each year, when 5 percent of the total number of tagged conelets and cones became infested with coneworm as determined by visual observation the first spray was to be applied to the "timed" area. Additional sprays were to be applied with each 3 percent increase in coneworm infestation level.

The formulation used for the "scheduled" and "timed" treatment in 1978 consisted of 11.3 l (24 pts) of Guthion 2S in 379 l (100 gal) of water. The formula used in 1979 was 5.4 kg or 12 lbs of Guthion 50 percent wettable powder in 379 l (100 gal) of water. They were applied using a mist blower at the rate of 7.57 l (2 gal) of mixture, or approximately 0.05 kg (0.12 lbs) active ingredient per tree.

The scheduled area was sprayed in mid-May, mid-June, mid-July, and mid-August during 1978 and 1979. The "timed" area was sprayed once in mid-June in 1978 when 5 percent or more of the conelets and cones showed damage. It was not sprayed in 1979 since the 5 percent criterion for spraying was not reached.

Each year in October, all the mature cones were collected from each sample tree. Cones were categorized as to "healthy", "coneworm damage", and "other damage". Six apparently sound cones were collected from each tree and subjected to Cone and Seed Analysis (CAS).^{4/} The seed potential was calculated by counting the number of fertile scales and multiplying by 2.

Analysis

A three-factor experiment design was used for the analyses. Two factors, treatment and clones, were crossed and the third factor, ramets, was nested within the clones. It was based on the assumption that there were no area or location effects. Response variables analyzed each year for conelets, cones plus conelets, cones monitored biweekly, and mature cones at harvest were: percent coneworm damage, percent other damage, and percent healthy. Response variables analyzed each year for seed were percent sound seed, percent empty seed, number of second year aborted ovules, and number of sound seeds per cone. The number of first-year aborted ovules and percents seedbug damage, seedworm damage, and seed efficiency^{5/} were also analyzed for 1979. Analysis of variance and multiple range tests were used to analyze data.

RESULTS

Conelet and Cone Damage

In June of 1978, coneworm infested conelets and cones reached 5 percent, therefore, a Guthion treatment was applied. Coneworm damage did not increase markedly after June, and no additional sprays were applied in the "timed" area. Coneworm damage to conelets and cones in the "timed" area for the entire season was 6 percent, compared to 4 percent in the "scheduled" spray and 9 percent in the check (Table 1). Both the "timed" and the "scheduled" spray areas were significantly different from the check for coneworm damage at the 5 percent level of significance. No significant difference occurred among any of the treatments for cones and conelets for percent healthy or percent other damage.

In 1979, the coneworm infestation level to conelets and cones reached only 3 percent in the "timed" area. Therefore, no sprays were applied to the area. No significant difference (5 percent level) occurred for coneworm damage between the "timed" area and either the check (3 percent) or the "scheduled" spray area (2 percent).

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CAS gives a comprehensive x-ray analysis of the status of each potential seed, including first and second year abortions, sound seeds, malformed seeds, empty seeds, and insect damaged seeds. All seeds are germinated.

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Seed efficiency = $\frac{\text{average number of sound seeds/cone}}{\text{seed potential}}$

Table 1. Percent conelet and cone damage to shortleaf pines according to biweekly inspections, Stuart Orchard, Pollock, La., February through October 1978.

Treatment	Healthy		Coneworm		Other	
	1978	1979	1978	1979	1978	1979
Guthion "timed"	59	61	6a ^{1/}	3	42	36
Guthion "scheduled"	60	63	4a	2	36	35
Check	41	58	9b	3	50	40

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Treatment means not followed by the same letter are significantly different from one another.

Table 2. Percent conelets damage to shortleaf pines, Stuart Orchard, Pollock, La., February 1978 through October 1979.

Treatment	Healthy		Coneworm		Other	
	1978	1979	1978	1979	1978	1979
Guthion "timed"	52	58	1	0	47	42
Guthion "scheduled"	54	69	1	0	45	31
Check	43	60	1	1	56	39

Table 3. Percent cone damage to shortleaf pines according to biweekly inspections, Stuart Orchard, Pollock, La., 1978 and 1979.

Treatment	Healthy		Coneworm		Other damage	
	1978	1979	1978	1979	1978	1979
Guthion "timed"	50a ^{1/}	57a	15a	6a	35a	37a
Guthion "scheduled"	72b	55a	11a	4a	17b	40a
Check	41a	58a	25b	10a	34a	32a

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Treatment means not followed by the same letter are significantly different from one another at the 5 percent level of significance.

Table 4. Percent cone damage to shortleaf pines, assessed at time of collection, October 1978, and October 1979, Stuart Seed Orchard, Pollock, La.

Treatment	Healthy		Coneworm		Other damage	
	1978	1979	1978	1979	1978	1979
Guthion "timed"	81a ^{1/}	85a	9a	9a	10a	7a
Guthion "scheduled"	74b	88a	10a	7a	16a	5a
Check	63c	82a	17b	10a	20a	9a

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Treatment means not followed by the same letter are significantly different from one another at the 5 percent level of significance.

Conelet Damage

In 1978 coneworm damage was approximately 1 percent for conelets in all three treatment areas (Table 2). Other damage was 47 percent in the "timed" area, 45 percent in the "scheduled" spray area, and 56 percent in the check area. None of the differences between treatments were significant at the 5 percent level of significance.

In 1979 coneworm damage on conelets again was low with no significant difference between treatments. No significant difference between treatments occurred for percent healthy conelets or percent of other damage to conelets.

Cone Damage (Biweekly Inspections)

For coneworm damage to cones, no significant difference (5 percent level) occurred between the "timed" spray and the "scheduled" spray in 1978 or 1979 (Table 3). Both of these treatments were significantly better than the check in 1978 but not in 1979. In 1978 the "scheduled spray" treatment showed a significantly higher percent of healthy cones than either the check or the "timed" treatment, and a significantly lower percent of damage due to other causes. The percentage of healthy cones was 50 for the "timed" treatment, 72 for the "scheduled" spray, and 41 percent for the check. The percentage of other damage was 35 for the "timed" treatment, 17 for the "scheduled" spray, and 34 for the check. No significant difference among treatments occurred in 1979 for healthy cones or other damage.

Cone Damage at Harvest

In 1978, coneworm damage was 9 percent on the "timed" area, compared to 10 percent on the "scheduled" spray area and 17 percent on the check area (Table 4). The check treatment was significantly higher than the "timed" or "scheduled" spray treatment for coneworm damage. No significant difference occurred between treatments for other damage at harvest. For healthy cones at harvest, the "scheduled" spray (81 percent) was significantly better (5 percent level of significance) than the timed area (74 percent), or the check (63 percent). The "timed" area was significantly better than the check for this category.

In 1979 no significant difference occurred between treatments for percent healthy cones, percent coneworm damaged cones or percent other damaged cones.

Seed Damage

In 1978 for percent sound seeds, number of sound seeds per cone, the "scheduled" spray area was significantly better than both the "timed" treatment and the check at the 5 percent level of significance (Table 5). The number of sound seeds per cone was 17 on the "scheduled" spray area, compared to two on the "timed" area and one on the check.

In 1979 no significant differences occurred among treatments (5 percent level) for first or second year aborted ovules per cone (Table 5). For number of sound seeds per cone, the Guthion "scheduled" treatment (49 sound seeds/cone) was significantly better than the Guthion "timed" treatment (39 sound seeds/cone) and the check treatment (36 sound seeds/cone). The Guthion "scheduled" treatment was significantly better than the other treatments for seed efficiency. It showed 50 percent seed efficiency compared with 40 percent for the Guthion "timed" treatment and 37 percent for the check. Percentage of identifiable seedbug damage to seed was significantly less for the Guthion "scheduled" treatment (2 percent) than either the Guthion "timed" treatment (10 percent) or the check treatment (13 percent). The seedworm infestation level was low for all treatments.

SUMMARY AND DISCUSSION

In 1978, one spray in June, timed according to coneworm infestation levels, was as successful for coneworm control as four sprays in May, June, July and August. However, other insect damage to cones was significantly greater in the "timed" area than the Guthion "scheduled" spray area. Damage to seeds was over 8 times greater in the "timed" area than in the "scheduled" spray area.

In 1979, biweekly examinations of cones and conelets for coneworm damage showed low levels of infestation; therefore, the timed area was not treated. However, seed damage was significantly greater (36 percent) in the "timed" area than the "scheduled" spray area.

Biweekly cone examination for coneworm damage for timing spray applications is time consuming. Although success at reducing the number of sprays for coneworm control was achieved, seedbug and other insects caused considerable damage to the "timed" areas as compared with the "scheduled" spray area. During the 2 years of the evaluation, coneworm damage did not continue to increase after early season. If coneworm populations reached high levels quickly and continued to increase thereafter, it is not known if populations could be detected using biweekly cone examination before extensive damage had already occurred.

If timing for coneworms is done in the future, it would probably be more practical to use pheromones to detect peak adult populations and then apply pesticides accordingly. However, if timing for coneworm control is done, it would also be necessary to time insecticide applications for seedbugs to prevent damage by these insects.

Forest Service Research, University Research and Forest Pest Management should cooperate to develop sampling techniques for use to time pesticide applications for coneworm and pine seedbug control. The next step would be in correlating damage with population estimates of individual insect species to determine economic thresholds.

Table 5. Seed data from Cone and Seed Analysis, Stuart Orchard, Pollock, La. 1978 and 1979.

Treatment	Number 1st yr aborted ovules/cone	Number 2nd yr aborted ovules/cone	Percent sound seed		Number of sound seed/cone		Percent identifiable seedbug damage		Percent identifiable seedworm damage		Seed efficiency ^{2/}	
	1979	1978 1979	1978 1979	1978 1979	1978 1979	1978 1979	1978 1979	1978 1979	1978 1979	1978 1979	1978 1979	1978 1979
Guthion "timed"	25a ^{1/}	2a 3a	10a 59a	2a 39a	-- 10a	-- .53a	-- 40a					
Guthion "scheduled"	19a	1a 4a	37b 67b	17b 49b	-- 2b	-- .08a	-- 50b					
Check	24a	3a 3a	17a 51c	1a 36a	-- 13a	-- .04b	-- 37a					

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Treatment means not followed by the same letter are significantly different from one another at least at the 5 percent level of significance.

^{2/}

Seed efficiency = $\frac{\text{average number of sound seeds/cone}}{\text{average number of fertile scales} \times 2}$

REFERENCES

Merkel, E.P. and D.O. Yandle.

1965. Mist blower application of insecticides for cone and seed insect control on slash pine. SE For. Exp. Sta., USDA Forest Service, Res. Note SE-52, 4 p.

PRECAUTIONARY STATEMENT

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key out of reach of children and animals and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid inhalation of pesticide sprays or dusts; wear protective clothing.

If your hands become contaminated with a pesticide, wash them immediately with soap and water. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove the clothing immediately and wash skin thoroughly. After handling or spraying pesticides, do not eat or drink until you have washed with soap and water.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicide from equipment, do not use the same equipment for insecticides or fungicides that you used for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary landfill dump, or crush and bury them in a level, isolated place.

NOTE: Some states have restrictions on the use of certain pesticides. Check your state and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Department of Agriculture, consult your county agent, state extension specialist or FPM to be sure the intended use is still registered. For further information or assistance, contact Forest Pest Management, Alexandria Field Office, Pineville, La., 71360, (Telephone: FTS 497-7280, or Commercial 318/473-7280).



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ORCHARD

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